

## ACCESSORY LOBES OF THE HUMAN LUNGS.

By WILLARD B. SOPER, M.D.,  
NEW HAVEN, CONN.

Until quite recently accessory lobes of the human lungs have been of but little interest except to the anatomist. To the clinician they were an unknown quantity. The X-ray has been disclosing them without their presence being appreciated. For years an unusual, fine, curved linear shadow was noted very occasionally in the upper right lung field, extending from the apex to terminate near the mediastinum not far from the level of the second costal cartilage. When recognized as due to a cause other than pleurisy, that cause was only here and there suspected as being an anomalous fissure separating off the so-called azygos lobe first described by Wrisberg in 1778. It remained for Bendick and Wessler in 1928 to definitely establish the fact through autopsies of two patients in whom the shadow was present: one in a child and one in an adult. Since then numerous articles regarding this lobe have been published here and abroad, and the shadow is now familiar to all who busy themselves with X-ray study for the lungs.

The size of the lobe varies considerably, as does therefore the location of the fissure shadow. At times the thin line lies close to the mediastinum, or again its convexity may be found relatively far out, even in the first interspace. There may or may not be a slight triangular density at the point where the linear shadow begins at the apex. Also at times one finds a slight uniform density over the azygos lobe as visualized mesial to the fissure line. The azygos lobe itself is a portion of the upper lobe cut off by the persistence of the foetal position of the azygos vein, which in foetal life lies lateral to the spine. The vein, therefore, traverses the substance of the upper lobe, lying in an infolding of the parietal pleura.

For a time some held that the fissure was visible only when the seat of a pachypleuritis; but this assumption was disproved by its visibility in children with negative tuberculin tests and by its occurrence in individuals in whom there was no reason whatever to sus-

pect a pathological thickening of the fissure. Its visibility must be explained then by the fact that there are present two layers of parietal pleura in addition to the two layers of visceral pleura. As to the small dense terminal shadow near the hilum, in the shape of a drop of water or an elongated cone, the explanation usually given is that the point of highest arching of the azygos vein offers an axial resistance to the passage of the rays.

In the autopsied cases reported by Bendick and Wessler, the accessory lobe bore no relation to the cause of death in either instance; in one case being due to carcinoma of the lung and in the other the result of an empyema. In the case of the child the bronchial tree was injected with an opaque substance which showed that the azygos lobe was supplied by a branch from the eparterial bronchus.

These authors develop the point that the accessory lobe is interesting not entirely as a roentgenological curiosity. As would be expected, it may be the seat of a lobar pathology or a pleuritis, rare though such an event may be. They report two such cases which, however, did not come to autopsy: one of an effusion in the azygos lobe fissure, and the other of a dense irregular infiltration undoubtedly due to some chronic disease of the lobe, but of undeterminable character. In one of their autopsied cases the lobe was the seat of an atelectasis, and Muller is cited as having observed a case in which the bronchus was narrowed by pressure from the azygos vein, to result in a diffuse fibrosis of the lobe and multiple dilatation.

Since the publication of the experience of Bendick and Wessler, several cases of pathology in the azygos lobe have been reported, chiefly from abroad. There was, however, an interesting case reported by Mackmull in the *American Review of Tuberculosis* in 1930. Tuberculosis of the right apex was diagnosed on the basis of frank dullness and persistent râles. The patient was a deaf mute and often maniacal so that X-ray films were not taken of the lungs. On the death of the patient from another cause the autopsy revealed no tuberculosis, but instead the presence of an azygos lobe on the right. The lobe is said to have had no separate or individual branches of the bronchus, pulmonary artery or vein supplying it, and the azygos vein emptied into the innominate instead of into the superior vena cava. The râles were regarded as due to interference with the normal blood

circulation and pulmonary ventilation by the constricting effect of the anomalous vessel.

During the past two years the azygos lobe has been of much interest to us on account of certain accidental findings.

The first was that of a lung specimen discovered at autopsy in a case of accidental death. So few of these specimens have been encountered, to judge by reports, that I have brought with me for demonstration this one from the pathological department of the Yale School of Medicine.

Next, an opportunity presented itself to form an opinion as to the relative frequency of this anomaly and fissure shadow. Among films of the chest taken routinely of 1600 students entering Yale University in 1930, there were 13 or 0.8% which showed the azygos lobe shadow. This percentage of frequency is rather higher than that of most others: Matter and Coope, 4 per 3000 radiograms; Zawadowski 3.3 per 1000; Levy and Cade, 8 per 1000. It should be added that we have observed the shadow a number of times in films of children, and presumably the frequency is here the same as in films of adults.

Finally, a case of unusual interest presented itself. Among the routine student films which in the fall of 1930 showed the shadow were those of a student in the Graduate School who stated that he had had hemoptyses ten years before and was treated for pulmonary tuberculosis. There had been no recurrence of the trouble, and on examination there was only a moderate dullness over the upper one third of the left lung to suggest the site of the possible earlier disease. This student in March, 1931, was taken to the New Haven Hospital suffering from an acute pneumococcus pneumonia. The radiographer, who was entirely unfamiliar with the University Health Department films and had no knowledge of the earlier azygos lobe finding in a different laboratory, made from the new X-ray films at the New Haven Hospital a diagnosis, among other pathology, of pneumonia of the azygos lobe. The X-ray diagnosis was apparently correct. The patient subsequently developed a pneumococcus empyema on the same side, underwent a thoracotomy and made a good recovery. The density of the azygos lobe resolved. The student did not return to Yale last September, but it was possible to have films made in Febru-

ary, 1932, through the courtesy of Dr. Forsythe of the Department of Student Health of the University of Michigan. We had rather expected that the linear shadow would now show the effects of a pleurisy and be markedly thickened. Such appears to be definitely the case, although the increase in the thickness and density of the fissure shadow is not perhaps as great as one would have expected.

The points to be brought out regarding the azygos lobe are then: The shadow is found in roughly 0.8% of all individuals, both children and adults. A visibility of the fissure is not necessarily a matter of pathology and in fact is usually not such. The lobe may, however, be the seat of pathology localized in the lobe itself and subject to the same influences as other purely lobar conditions. And the fissure may be the site of a pleurisy or an exudate. Consolidation of the azygos lobe as such, if not borne in mind, may easily be mistaken for other pathological conditions causing X-ray densities to the right of the upper thoracic vertebrae.

Still another accessory lobe is perhaps of greater interest because so little apparently is known about it and it has not yet found its way into the literature to any extent. I refer to the inferior accessory lobes. Our interest was aroused by an article on basal paramediastinal triangular shadows by Graberger, which appeared in *Acta Radiologica* in July, 1931. It dealt essentially with the inferior accessory lobes and I shall draw upon it largely, except as regards our personal experience.

Comparative anatomists have always known that in quadrupeds an inferior accessory lobe exists almost regularly on the right. Rektorzik in 1861 first described it as at times found in man and homologous with the lobe found in quadrupeds, lying between the pericardium and the diaphragm in the subpericardial sinus.

Schaffner in 1898 in *Virchow's Archiv* described it thoroughly. An inferior accessory lobe may be found on both the right and left sides and, according to Schaffner, is on the right constantly supplied by the heart bronchus and therefore corresponds exactly to the heart lobe of animals. On the left the lobe is always supplied by the inner branch of the second ventral bronchus. The lobe may be completely separate from the lower lobe or partially so to any degree. Schaffner states that it occurs approximately equally often on the right and

the left. In his group of 210 lungs studied, with findings on the left and right taken together, the lobe was found to a varying degree 96 times or in 45.7%: the lobe was quite separate fifteen times on the right and thirteen times on the left: only partially separate thirty-one times on the right and thirty-seven times on the left. In three instances there were completely separate lobes on both sides and in fifteen instances partially separate lobes on both sides.

Schaffner's description of the inferior accessory lobe is here translated: "When the lobe is completely separate there is found a one half to two centimeters deep incisure going out from the pulmonary ligament on the under surface of the lower lobe. The incisure goes forward and a little outward in a curve, with the convexity outward and fairly parallel to the outer sharp border of the lower lobe, and ends more or less far forward in the mesial margin of the lower lobe, adjacent upon the right to the middle lobe and on the left to the cardiac lappet. This incisure does not run perpendicularly into the depth of the lung from its surface, but obliquely at a fairly sharp angle, or better stated, from the free margin of the inferior accessory lobe obliquely inward and a little upward toward the root of the lung. It thus creates a tongue shaped lappet with its tip directed forward. The inferior accessory lobe is not always of the same size. Usually its under surface equals from a third to a fifth of the under surface of the lower lobe, including the inferior accessory lobe. The incisure marking off the lobe may, when the pleura is incised, be followed not seldom to the hilum, particularly in foetal lungs.

"If the inferior accessory lobe is not completely separated by the incisure from the under surface of the lower lobe, one finds every possible stage from the scarcely appreciable to the almost complete separation. In the majority of cases one finds then the tongue shaped tip of the lobe distinctly set apart from the mesial border of the lower lobe by a deep incisure. This incisure which curves backward on the under surface of the lower lobe, often a little outward, becomes gradually less marked and loses itself in the middle of the under surface of the lower lobe. This under surface lying upon the diaphragm is then arched uniformly and smoothly without interruption from the end of the incisure to the pulmonary ligament. If, however, one looks

more closely one can in many cases follow the limit of the inferior accessory lobe to its posterior endings in front of the attachment of the pulmonary ligament. There is then noted a pale line which is the continuation of the incisure further in the same direction.

"In other instances the tongue shaped tip of the lappet is lacking on the mesial lower lobe margin. There is then a scarcely appreciable indentation at this point, as also in front of the pulmonary ligament attachment. These indentations are connected by a slight incisure which running bow shaped outward marks off the contour of the lappet. Of these three types there are all possible variations."

There exists not seldom, therefore, an inferior accessory lobe of the human lung, apparently too little appreciated and not sufficiently considered by roentgenologists in explaining the triangular densities in the cardio-diaphragmatic angle. The usual picture of the inferior accessory lobe offers an explanation for the form of the common triangular shadow, with its sharp and straight or almost straight lateral border. Shadows of this form may be due to an infiltrated or atelectatic inferior accessory lobe. The disease process in the lobe may probably often be on the basis of a bronchiectasis; at the same time bronchiectasis alone and by itself can never explain the presence of the sharp straight border. Assman is cited as describing in his textbook an infiltration, at autopsy, of an inferior accessory lobe on the left whose shadow showed through that of the heart. Ettig describes a case diagnosed and verified at autopsy of a chronic pneumonia in the left accessory lobe. Graberger describes a case of his own of a triangular density on the right which absorbed to leave behind the characteristic diagonal linear shadow of the interlobar fissure from the diaphragm to the hilum. Of two other cases of shadows on the left, one was regarded as due to infiltration of the accessory lobe with tuberculosis, the other, which was autopsied, as caused by bronchiectasis. In four other instances the typical fissure shadow was found.

With our own interest aroused by the above description we have found in our material six instances of linear shadows corresponding to the described fissure between the inferior accessory lobe and the lower lobe, all on the right, and none on the left. The majority were seen in films of normal, healthy students. Graberger states that he

has never found a linear shadow on the left and well explains the fact on the ground that so delicate a shadow would be invisible in the heart density. An inferior accessory lobe on the left can probably never be identified unless it be the seat of pathology such as to cast a shadow visible through the heart density.

The work of Laurell is here introduced as explaining the so-called tentings of the diaphragm, often regarded as evidence of adhesion between the lung and the diaphragm. Those approximately upon the outer half of the diaphragm are directed outward and may occasionally continue into a visible fine line of the fissure of the lower lobe. Those of the mesial half are directed inward. Laurell regards the actual tentings as due to fluid in the shallow notch at the lower extremities of the fissures, the inner tenting being often the only evidence of the presence of an inferior accessory lobe.

In the differential diagnosis Graberger, after laying great stress upon the straightness of the outer margin of the inferior accessory lobe shadow, speaks first of sacculated basal exudate. This condition according to him creates a shadow, which on account of the elasticity of the lung and the hydrostatic pressure of the fluid, shows an outward convexity, at least in almost all instances. Only in exceptional cases is the edge of the shadow a straight line. Large costo-mediastinal thickenings after a pleural exudate show usually a concave lateral margin.

Atelectasis of the entire lower lobe on either side or of the middle lobe on the right can produce a fairly straight lateral margin of the triangular paramediastinal basal shadow. Here, however, there is other roentgenological evidence pointing to atelectasis: evidence of compensatory emphysema of the lung immediately adjacent to the margin of the atelectasis, a little attraction of the mediastinum and a drawing up of the mesial portion of the diaphragm, as well as a definite swing of the mediastinum with respiration. Other conditions to be differentiated are said to include dilatation of the left auricle, retrocardiac aneurysm, cold abscess from the dorsal vertebrae, parasophageal breaking through of the diaphragm, scoliosis, and dilatation of the esophagus. On the right side there must further be considered an abnormally high opening of a liver vein into the inferior vena cava, as well as the inferior vena cava filling the heart liver

angle. These conditions should offer no great difficulty in the differential.

In one case in our own material of which I have the films, the inferior accessory lobe was diagnosed and later confirmed at autopsy. We have yet to diagnose the accessory lobe harboring a pathological process, but such a case should occur. We are constantly on the lookout for triangular paramediastinal basal shadows with a sharp, straight border extending from the middle of the diaphragm, or somewhat inside the middle, upward and inward diagonally to the hilum and unexplained on grounds other than of pathology in the inferior accessory lobe.

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#### DISCUSSION.

DR. CHARLES H. COCKE: I just wanted to ask Dr. Soper whether the azygos lobe occurs at a fairly constant level.

DR. LAWRASON BROWN: I understand that bronchiectasis may develop in the lower accessory lobe. Has there not been some recent literature which shows that?

DR. HARRY A. BRAY: One of the strangest coincidences that I can recall in medicine occurred last year in relation to the anomaly described by Dr. Soper. One of the residents of the Cornell division of Bellevue Hospital was shown by the radiologist a shadow which the radiologist told him represented the azygos lobe. A few days later he was in the morgue and he asked the pathologist in charge to demonstrate this lobe, and the pathologist said, "I am going to perform an autopsy on this cadaver and I will show it to you." When the lung was exposed there was a beautiful example of the azygos lobe. The resident departed. I arrived a little later and the pathologist told me in a rather hurt voice that the resident had not even thanked him for this amazing demonstration.

I have followed at Bellevue Hospital the autopsies rather actively for the past ten years. I have observed many lung specimens in that time, and in that series this was the first case of azygos lobe that I observed. I feel that pathologists—I mean authoritative pathologists, careful men—have not been able to



fully substantiate these radiographic claims. They may in the future, but certainly I just wish to say that it is the universal opinion among authoritative pathologists that that anomaly does not occur as often as the X-ray man claims it does.

There is just one other word I would like to say in regard to the tenting of the center of the diaphragmatic shadow. I think that tenting represents the interlobular fissure between the upper and middle lobes; at least in three autopsies which we have followed by a post-mortem film that has been the case.

DR. SOPER: Replying to Dr. Cocke's question about the level, if we take a glance at the film we will see it varies. The French have been showing how often these triangular shadows are a manifestation of bronchiectasis, and that does introduce a complication.

As an aside, Graberger maintains that the characteristic shadow is a very marked one, with a sharp margin on the right side, and the bronchoscope alone, not being limited to the lobe, is not apt to show such a very sharp right linear margin.

As to Dr. Bray's point about the pathologist not being able to detect the azygos lobe. When you are looking for things you usually find them, and I have no doubt that these lobes have been overlooked many, many times.